

Claims

- [c1] 1.A combination vacuum and pressure pump comprising:
- a pump housing having an opening for connection to a container to be evacuated or pressurized;
 - a pump chamber within the pump housing;
 - a piston in sliding, substantially airtight engagement with walls of the pump chamber, adapted to reciprocate between pressure and vacuum strokes within the chamber;
 - a rotary drive in the pump housing powering a rotatable output shaft;
 - a piston drive operatively connecting the motor output shaft and the piston adapted to convert rotational movement of the output shaft to reciprocating motion of the piston within the pump chamber;
 - at least one one-way valve, communicating with the pump chamber, permitting passage of fluid only into or out of the pump chamber;
 - a selectable flow control member in the pump housing having a pair of passages therein and movable between pressure and vacuum positions;
 - in the pressure position one of the selectable flow control member passages connecting the pump chamber

and the pump housing opening to permit passage of fluid from the pump chamber out of the housing connection opening during the piston pressure stroke, and the other of the selectable flow control member passages permitting passage of fluid into the pump chamber from a region external to the pump chamber through a one-way valve during the piston vacuum stroke; and in the vacuum position one of the first selectable flow control member passages connecting a one-way valve to the pump chamber to permit passage of fluid from the pump chamber out to the external region through the one-way valve during the piston pressure stroke, and the other of the selectable flow control member passages permitting passage of fluid from the housing connection opening to the pump chamber during the piston vacuum stroke.

- [c2] 2.The pump of claim 1 wherein the selectable flow control member has a first passage extending from one side to the other, and the one-way valve is disposed in the selectable flow control member first passage, the selectable flow control member being rotatable: i) in the pressure position, to place the one-way valve in an orientation to permit passage of fluid only into the piston chamber, and ii) in the vacuum position, to place the one-way valve in an orientation to permit passage of

fluid only out of the piston chamber.

[c3] 3.The pump of claim 1 wherein the selectable flow control member has a pair of passages extending from one side to the other, and including a first one-way valve disposed in one of the selectable flow control member passages and a second one-way valve disposed in the other of the selectable flow control member passages, the one way valves being disposed in opposite orientations in the passages, the selectable flow control member being rotatable: i) in the pressure position, to place the first one-way valve in an orientation to permit passage of fluid from the external region only into the piston chamber and to place the second one-way valve in an orientation to permit passage of fluid only out from the piston chamber and through the housing connection opening, and ii) in the vacuum position, to place the first one-way valve in an orientation to permit passage of fluid from the piston chamber only out to the external region and to place the second one-way valve in an orientation to permit passage of fluid only into the piston chamber from the housing connection opening.

[c4] 4.The pump of claim 1 including:
a pair of one-way valves communicating with the pump chamber, the first one-way chamber valve permitting passage of fluid only into the pump chamber, and the

second one-way chamber valve permitting passage of fluid only out of the pump chamber;

a pair of one-way valves communicating externally to the pump housing, the first one-way external valve permitting passage of fluid only out to a region external to the pump housing, and the second one-way external valve permitting passage of fluid only out of the housing connection opening;

and wherein the selectable flow control member is disposed in the pump housing between the one-way chamber valves and the one-way external valves, the selectable flow control member having a pair of passages therein and movable between pressure and vacuum positions,

in the pressure position the first selectable flow control member passage connecting the second one-way chamber valve to the housing connection opening and the second selectable flow control member passage connecting the pump chamber to the second one-way external valve, thereby permitting passage of fluid from the pump chamber out of the housing connection opening during the piston pressure stroke, and permitting passage of fluid from the external region to the pump chamber during the piston vacuum stroke, and

in the vacuum position the first selectable flow control member passage connecting the pump chamber to the

first external valve opening and the second selectable flow control member passage connecting the first chamber valve to the housing connection opening, thereby permitting passage of fluid from the pump chamber out to the external region during the piston pressure stroke, and permitting passage of fluid from the housing connection opening to the pump chamber during the piston vacuum stroke.

[c5] 5.The pump of claim 1 wherein the piston drive comprises a member extending transversely to the direction of movement of the piston and a track extending circumferentially around and engaging the transversely extending member in sliding relationship, the track having a non-linear configuration such that, upon rotation of the output shaft, the transversely extending member slides with respect to the track and imparts a reciprocating motion to the operatively connected piston within the pump chamber.

[c6] 6.The pump of claim 1 wherein the selectable flow control member comprises a body rotatably received within a cavity in the pump housing, and wherein the passage therein extends from one side surface of the body to the other side surface of the body.

[c7] 7.The pump of claim 1 wherein the selectable flow con-

trol member comprises a cylindrical body rotatably received within a cavity in the pump housing, and wherein the passage therein extends from an opening on one side surface of the body to an opening on the other side surface of the body, and further including a seal extending around the flow control member body, between the body and the cavity, separating the passage openings on each side surface of the flow control member body.

[c8] 8.The pump of claim 1 wherein the selectable flow control member is rotatably received within a cavity in the pump housing, and further including a handle extending outward of the pump housing for rotating the selectable flow control member between the pressure and vacuum positions.

[c9] 9.The pump of claim 1 wherein the rotary drive comprises an electric motor.

[c10] 10.The pump of claim 5 wherein the track has a substantially sinusoidal configuration.

[c11] 11.The pump of claim 5 wherein the transversely extending member comprises at least one wheel slidably received in the track.

[c12] 12.The pump of claim 5 wherein the transversely extending member comprises at least one wheel slidably

captured in the track, the track having a substantially sinusoidal configuration.

[c13] 13.The pump of claim 5 wherein the track extends circumferentially around an interior wall of a reciprocating drive member connected to the piston.

[c14] 14.The pump of claim 5 wherein the transversely extending member is disposed on a rotatable drive member operatively connected to the motor output shaft.

[c15] 15.The pump of claim 5 wherein the track extends circumferentially around an interior wall of a reciprocating drive member operatively connected to the piston and the transversely extending member is disposed on a rotatable drive member operatively connected to the motor output shaft, the rotatable drive member extending within the reciprocating drive member and adapted to rotate the transversely extending member to cause the transversely extending member to slide within the track and impart reciprocating motion to the operatively connected piston within the pump chamber.

[c16] 16.The pump of claim 1 wherein the one-way valve comprises a valve seat having an opening therein; and a valve diaphragm having a sealing member supported by flexible arms in a normally biased position against and

sealing the valve seat opening, wherein when a fluid is forced in a first direction through the valve seat opening against the sealing member, the arms flex and move the sealing member away from the valve seat opening to permit fluid flow out of the valve seat opening, and when the fluid is forced in a direction opposite the first direction, the arms do not flex and the sealing member remains in the normally biased position against and sealing the valve seat opening to restrict fluid flow.

[c17] 17.The pump of claim 16 wherein the sealing member comprises a bulb or cap suspended by a plurality of radially extending arms attached to the valve seat outward of the valve seat opening.

[c18] 18.A combination vacuum and pressure pump comprising:

a pump housing having an opening for connection to a container to be evacuated or pressurized;

a pump chamber within the pump housing;

a piston in sliding, substantially airtight engagement with walls of the pump chamber, adapted to reciprocate between pressure and vacuum strokes within the chamber;

at least one one-way valve communicating with the pump chamber, permitting passage of fluid only into or out of the pump chamber;

a selectable flow control member in the pump housing having a pair of passages therein and movable between pressure and vacuum positions;
in the pressure position one of the selectable flow control member passages connecting the pump chamber and the pump housing opening to permit passage of fluid from the pump chamber out of the housing connection opening during the piston pressure stroke, and the other of the selectable flow control member passages permitting passage of fluid into the pump chamber from a region external to the pump chamber through a one-way valve during the piston vacuum stroke; and
in the vacuum position one of the first selectable flow control member passages connecting a one-way valve to the pump chamber to permit passage of fluid from the pump chamber out to the external region through the one-way valve during the piston pressure stroke, and the other of the selectable flow control member passages permitting passage of fluid from the housing connection opening to the pump chamber during the piston vacuum stroke.

[c19] 19. The pump of claim 18 wherein the selectable flow control member has a first passage extending from one side to the other, and the one-way valve is disposed in the selectable flow control member first passage, the se-

selectable flow control member being rotatable: i) in the pressure position, to place the one-way valve in an orientation to permit passage of fluid only into the piston chamber, and ii) in the vacuum position, to place the one-way valve in an orientation to permit passage of fluid only out of the piston chamber.

[c20] 20. The pump of claim 18 wherein the selectable flow control member has a pair of passages extending from one side to the other, and including a first one-way valve disposed in one of the selectable flow control member passages and a second one-way valve disposed in the other of the selectable flow control member passages the one way valves being disposed in opposite positions in the passages, the selectable flow control member being rotatable: i) in the pressure position, to place the first one-way valve in an orientation to permit passage of fluid from the external region only into the piston chamber and to place the second one-way valve in an orientation to permit passage of fluid only out from the piston chamber and through the housing connection opening, and ii) in the vacuum position, to place the first one-way valve in an orientation to permit passage of fluid from the piston chamber only out to the external region and to place the second one-way valve in an orientation to permit passage of fluid only into the piston

chamber from the housing connection opening.

[c21] 21. The pump of claim 18 including:
a pair of one-way valves communicating with the pump chamber, the first one-way chamber valve permitting passage of air only into the pump chamber, and the second one-way chamber valve permitting passage of air only out of the pump chamber;
a pair of one-way valves communicating externally to the pump housing, the first one-way external valve permitting passage of air only out to atmosphere surrounding the pump housing, and the second one-way external valve permitting passage of air only out of the housing connection opening;
and wherein the selectable flow control member is disposed in the pump housing between the one-way chamber valves and the one-way external valves, the selectable flow control member having a pair of passages therein and movable between pressure and vacuum positions,
in the pressure position the first selectable member passage connecting the second one-way chamber valve to the housing connection opening and the second selectable member passage connecting the pump chamber to the second one-way external valve, thereby permitting passage of air from the pump chamber out of the hous-

ing connection opening during the piston pressure stroke, and permitting passage of air from the atmosphere to the pump chamber during the piston vacuum stroke, and

in the vacuum position the first selectable member passage connecting the pump chamber to the first external valve opening and the second selectable member passage connecting the first chamber valve to the housing connection opening, thereby permitting passage of air from the pump chamber out to the atmosphere during the piston pressure stroke, and permitting passage of air from the housing connection opening to the pump chamber during the piston vacuum stroke.

[c22] 22.The pump of claim 18 wherein the selectable flow control member comprises a body rotatingly received within a cavity in the pump housing, and wherein the passages therein extend from one side surface of the body to the other side surface of the body.

[c23] 23.The pump of claim 18 wherein the selectable flow control member comprises a cylindrical body rotatingly received within a cylindrical cavity in the pump housing.

[c24] 24.The pump of claim 18 wherein the selectable flow control member comprises a body rotatingly received within a cavity in the pump housing, and wherein the

passages therein extend from an opening on one side surface of the body to an opening on the other side surface of the body, and further including a seal extending around the body, between the body and valve cavity, separating the passage openings on each side surface of the body.

[c25] 25.The pump of claim 18 wherein the selectable flow control member is rotatably received within a cavity in the pump housing, and further including a handle extending outward of the pump housing for rotating the selectable flow control member between the pressure and vacuum positions.

[c26] 26.The pump of claim 18 wherein the one-way valve comprises a valve seat having an opening therein; and a valve diaphragm having a sealing member supported by flexible arms in a normally biased position against and sealing the valve seat opening, wherein when a fluid is forced in a first direction through the valve seat opening against the sealing member, the arms flex and move the sealing member away from the valve seat opening to permit fluid flow out of the valve seat opening, and when the fluid is forced in a direction opposite the first direction, the arms do not flex and the sealing member remains in the normally biased position against and sealing the valve seat opening to restrict fluid flow.

- [c27] 27.The pump of claim 26 wherein the sealing member comprises a bulb or cap suspended by a plurality of radially extending arms attached to the valve seat outward of the valve seat opening.
- [c28] 28.The pump of claim 18 further including a motor for reciprocating the piston within the pump chamber.
- [c29] 29.The pump of claim 18 further including a motor having a rotating output shaft and a piston drive for converting rotary movement of the output shaft to reciprocating motion of the piston within the pump chamber.
- [c30] 30.The pump of claim 18 further including a motor having a rotating output shaft and a piston drive for converting rotary movement of the output shaft to reciprocating motion of the piston within the pump chamber, the piston drive comprising a member extending transversely to the direction of movement of the piston and a track extending circumferentially around and engaging the transversely extending member in sliding relationship, the track having a non-linear configuration such that, upon rotation of the output shaft, the transversely extending member slides with respect to the track and imparts a reciprocating motion to the piston within the pump chamber.

[c31] 31.The pump of claim 18, wherein the pump housing opening is removably connected to an opening of a food or drink container.

[c32] 32.The pump of claim 18, wherein the pump housing opening is removably connected to a one-way stopper in an opening of a food or drink container.

[c33] 33.A pump comprising:
a pump housing having a pump chamber;
a piston in sliding, substantially airtight engagement with walls of the pump chamber, adapted to reciprocate in a direction between pressure and vacuum strokes within the chamber, for pumping air into or out of the pump;
a motor in the pump housing powering a rotatable output shaft; and
a piston drive operatively connecting the motor output shaft and the piston comprising a member extending transversely to the direction of movement of the piston and a track extending circumferentially around and engaging the transversely extending member in sliding relationship, the track having a non-linear configuration such that, upon rotation of the output shaft, the transversely extending member slides with respect to the track and imparts a reciprocating motion to the opera-

tively connected piston within the pump chamber.

- [c34] 34.The pump of claim 33 wherein the track has a substantially sinusoidal configuration.
- [c35] 35.The pump of claim 33 wherein the transversely extending member comprises at least one wheel slidingly received in the track.
- [c36] 36.The pump of claim 33 wherein the transversely extending member comprises at least one wheel slidingly captured in the track, the track having a substantially sinusoidal configuration.
- [c37] 37.The pump of claim 33 wherein the track extends circumferentially around an interior wall of a reciprocating drive member connected to the piston.
- [c38] 38.The pump of claim 33 wherein the transversely extending member is disposed on a rotatable drive member operatively connected to the motor output shaft.
- [c39] 39.The pump of claim 33 wherein the track extends circumferentially around an interior wall of a reciprocating drive member operatively connected to the piston and the transversely extending member is disposed on a rotatable drive member operatively connected to the motor output shaft, the rotatable drive member extending

within the reciprocating drive member and adapted to rotate the transversely extending member to cause the transversely extending member to slide within the track and impart reciprocating motion to the operatively connected piston within the pump chamber.

[c40] 40. A pump comprising a pump chamber, a piston in the pump chamber, and a one-way valve communicating with the pump chamber comprising:
a valve seat having an opening therein; and
a valve diaphragm having a sealing member supported by flexible arms in a normally biased position against and sealing the valve seat opening, wherein when a fluid is forced in a first direction through the valve seat opening against the sealing member, the arms flex and move the sealing member away from the valve seat opening to permit fluid flow out of the valve seat opening, and when the fluid is forced in a direction opposite the first direction, the arms do not flex and the sealing member remains in the normally biased position against and sealing the valve seat opening to restrict fluid flow.

[c41] 41. The pump of claim 40 wherein the sealing member comprises a bulb or cap suspended by a plurality of radially extending arms attached to the valve seat outward of the valve seat opening.

[c42] 42. A stopper for contacting and sealing with an opening in a container, the stopper having an opening therethrough between the container interior and exterior and a one-way valve disposed in the opening, the one-way valve comprising:

a valve seat having an opening therein; and

a valve diaphragm having a sealing member supported by flexible arms in a normally biased position against and sealing the valve seat opening, wherein when a fluid is forced in a first direction through the valve seat opening against the sealing member, the arms flex and move the sealing member away from the valve seat opening to permit fluid flow out of the valve seat opening, and when the fluid is forced in a direction opposite the first direction, the arms do not flex and the sealing member remains in the normally biased position against and sealing the valve seat opening to restrict fluid flow.

[c43] 43. The stopper of claim 42 wherein the sealing member comprises a bulb or cap suspended by a plurality of radially extending arms attached to the valve seat outward of the valve seat opening.

[c44] 44. The stopper of claim 42 further including a selectable flow control member in the stopper opening having at least one passage therein and movable between pressure and vacuum positions, the one-way valve being disposed

in the selectable flow control member passage, the selectable flow control member being rotatable: i) in the pressure position, to place the one-way valve in an orientation to permit passage of fluid only into the container interior, and ii) in the vacuum position, to place the one-way valve in an orientation to permit passage of fluid only out of the container interior.

[c45] 45. The stopper of claim 42 wherein the stopper opening between the container interior and exterior includes a central pour opening for pouring out the contents of the container when the container is tipped from an upright position, and at least one parallel passageway adjacent the central pour opening to permit air to flow into the container to release back pressure.

[c46] 46. A stopper for contacting and sealing with an opening in a container, the stopper having a pour opening for accessing contents in the container, the pour opening being movable between open and closed positions, and a one-way valve movably disposed in the stopper between an operative position to permit one-way flow of fluid into or out of the container when the pour opening is in the closed position, and an inoperative position when the pour opening is in the open position.

[c47] 47. The stopper of claim 46 wherein the one-way valve is

movable to a first operative position when the pour opening is in the closed position to permit one-way flow of fluid into the container, and to a second operative position when the pour opening is in the closed position to permit one-way flow of fluid out of the container.

[c48] 48. The stopper of claim 46 wherein the stopper includes a rotatable ball valve body having the pour opening disposed therein in a first direction, and the one-way valve disposed therein in a second direction, the ball valve body being movable between the first and second directions to open and close the pour opening, and respectively render inoperative and operative the one-way valve.

[c49] 49. The stopper of claim 46 wherein the one-way valve comprises a valve seat having an opening therein; and a valve diaphragm having a sealing member supported by flexible arms in a normally biased position against and sealing the valve seat opening, wherein when a fluid is forced in a first direction through the valve seat opening against the sealing member, the arms flex and move the sealing member away from the valve seat opening to permit fluid flow out of the valve seat opening, and when the fluid is forced in a direction opposite the first direction, the arms do not flex and the sealing member remains in the normally biased position against and seal-

ing the valve seat opening to restrict fluid flow.

[c50] 50.The stopper of claim 46 wherein the stopper further includes a central pour opening for pouring out the contents of the container when the container is tipped from an upright position, and at least one parallel passageway adjacent the central pour opening to permit air to flow into the container to release back pressure.

[c51] 51.A pump comprising a housing, a pump chamber in the housing, a piston slidable in the pump chamber, and an indicator for indicating when a desired level of vacuum or pressure has been reached comprising a flexible membrane exposed to atmospheric pressure outside the pump and to fluid pressure present within the pump chamber, a movable electrical contact operatively connected to the membrane to complete one circuit when the pressure in the pump falls to a desired pressure below atmospheric pressure, and complete another circuit when the pressure in the pump rises to a desired pressure above atmospheric pressure, and an indicator signal energizable when the movable electrical contact completes either one or the other circuit.

[c52] 52.A pump and stopper combination comprising:
a stopper for contacting and sealing with an opening in a container, the stopper having a pour opening for access—

ing contents in the container, the pour opening being movable between open and closed positions, and a one-way valve movably disposed in the stopper between an operative position to permit one-way flow of fluid into or out of the container when the pour opening is in the closed position, and an inoperative position when the pour opening is in the open position, the one-way stopper valve comprising a valve seat having an opening therein; and a valve diaphragm having a sealing member supported by flexible arms in a normally biased position against and sealing the valve seat opening, wherein when a fluid is forced in a first direction through the valve seat opening against the sealing member, the arms flex and move the sealing member away from the valve seat opening to permit fluid flow out of the valve seat opening, and when the fluid is forced in a direction opposite the first direction, the arms do not flex and the sealing member remains in the normally biased position against and sealing the valve seat opening to restrict fluid flow; and

a vacuum/pressure pump comprising a pump housing having an opening for connection to said stopper; a pump chamber within the pump housing; a piston in sliding, substantially airtight engagement with walls of the pump chamber, adapted to reciprocate between pressure and vacuum strokes within the chamber; a ro-

tary drive in the pump housing powering a rotatable output shaft; a piston drive operatively connecting the motor output shaft and the piston adapted to convert rotational movement of the output shaft to reciprocating motion of the piston within the pump chamber; at least one one-way pump valve, communicating with the pump chamber, permitting passage of fluid only into or out of the pump chamber; a selectable flow control member in the pump housing having a pair of passages therein and movable between pressure and vacuum positions; in the pressure position one of the selectable flow control member passages connecting the pump chamber and the pump housing opening to permit passage of fluid from the pump chamber out of the housing connection opening during the piston pressure stroke, and the other of the selectable flow control member passages permitting passage of fluid into the pump chamber from a region external to the pump chamber through a one-way pump valve during the piston vacuum stroke; and in the vacuum position one of the first selectable flow control member passages connecting a one-way pump valve to the pump chamber to permit passage of fluid from the pump chamber out to the external region through the one-way valve during the piston pressure stroke, and the other of the selectable flow control member passages permitting passage of fluid from the housing connection

opening to the pump chamber during the piston vacuum stroke; and an indicator for indicating when a desired level of vacuum or pressure has been reached comprising a flexible membrane exposed to atmospheric pressure outside the pump and to fluid pressure present within the pump chamber, a movable electrical contact operatively connected to the membrane to complete one circuit when the pressure in the pump falls to a desired pressure below atmospheric pressure, and complete another circuit when the pressure in the pump rises to a desired pressure above atmospheric pressure, and an indicator signal energizable when the movable electrical contact completes either one or the other circuit.

[c53] 53. A lid for a container to be maintained at a predetermined vacuum or pressure condition comprising a lid portion adapted to seal to the opening of a container, a vacuum or pressure pump having passages for removing or adding fluid through the lid portion, a motor attached to the lid for operating the pump, a battery attached to the lid for energizing the motor, and an electrical circuit connecting the battery and motor including a normally-closed indicator contact which is opened by an indicator when pressure in the container reaches a predetermined level above or below that outside the container and a normally-opened switch contact closed by a switch when

the lid is attached and sealed to a container, wherein when the lid is initially attached and sealed to the container, the indicator and switch contacts are closed and the pump removes or adds fluid to the container through the lid until pressure in the container reaches a predetermined level, whereupon the indicator contact opens, and wherein when the lid is removed from the container the switch contact opens and the pump is inoperable.

[c54] 54. The lid of claim 53 wherein the pump is a vacuum pump and the indicator includes a normally-closed indicator contact which is opened when pressure in the container reaches a predetermined level below that outside the container.